SCIENTIFIC LETTER

Plasma concentrations of D-dimer predict mortality in acute type A aortic dissection

T Weber, M Rammer, J Auer, E Maurer, G Aspöck, B Eber

Heart 2006;**92**:836–837. doi: 10.1136/hrt.2005.072959

Acute type A aortic dissection is a relatively uncommon, although potentially life threatening, disease. Given the high mortality, predictive tools to identify patients at increased risk of death are needed to assist clinicians in optimal treatment. Known prognostic parameters are: age > 70 years; abrupt onset of chest pain; hypotension, shock, or tamponade; renal failure at presentation; pulse deficit; and abnormal ECG, particularly ST segment elevation.[1]

Recently we found that concentrations of D-dimer, a degradation product of cross linked fibrin, were raised in all cases of acute aortic dissection and, therefore, normal D-dimer concentrations can be used to rule out the disease.[2] Our results were subsequently confirmed by others.[3] However, owing to small patient numbers in both studies, no firm conclusions about the prognostic significance of absolute D-dimer concentrations can be drawn.

METHODS

We measured plasma concentrations of D-dimer in 27 patients with acute type A dissection of the aorta by using the Tina-quant assay (Roche Diagnostics, Mannheim, Germany) on an automated chemical analysis system (model 704; Hitachi, Tokyo, Japan) as previously described.[2] Twelve of these patients have been reported on previously (submitted in 2002); the others have been investigated prospectively and consecutively since then to clarify whether higher D-dimer concentrations confer a worse prognosis. The diagnosis was confirmed for all patients with computed tomography, echocardiography, or necropsy. Prognosis was assessed as in-hospital mortality. Values are absolute numbers (percentage) or median (25–75% interquartile range), unless otherwise stated. Statistical analyses were Mann-Whitney U test for univariate comparisons between the outcome groups and a logistic regression model (including variables associated significantly or marginally with outcome or D-dimer concentrations in univariate analysis) for the prediction of in-hospital mortality.

RESULTS

Mean (SD) age of our patients was 62 (16) years and 15 (55.6%) were men. Seventeen patients (63%) were operated on and the others were treated conservatively due to severe co-morbidities, advanced age, or refusal of the patient or the surgeon. Thirteen patients died (48.1%) during their hospital stay and 14 survived (51.9%).

In agreement with our previous study, D-dimer concentrations were increased (> 0.5 μg/ml) in all patients. D-dimer concentrations were higher in patients who died than in survivors (fig 1, table 1). Other significant predictors of mortality in univariate analysis were a lower diastolic blood pressure on admission and a conservative treatment strategy. Stratified analysis for each treatment strategy showed that D-dimer concentrations were significantly higher in patients who died than in survivors in surgically as well as in medically treated patients (table 1). In the logistic regression model (p = 0.002; the model predicted survival status correctly for 89% of patients), D-dimer was the only independent predictor of mortality (odds ratio 1.32 per unit, 95% confidence interval 1.01 to 1.75, p = 0.046). Other variables included in the model, but not reaching significance, were age, diastolic blood pressure, treatment strategy, ECG evidence of left ventricular hypertrophy (Sokolow or Cornell index), and anatomical extent of disease.

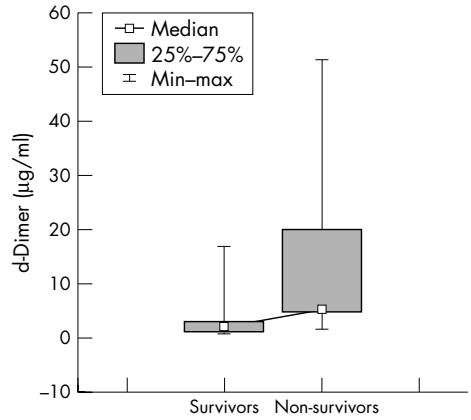


Figure 1 Plasma concentrations of D-dimer and in-hospital mortality in patients with acute type A aortic dissection.

Table 1 D-dimer concentrations (μg/ml) on hospital admission in patients with acute type A aortic dissection

Patient group	No	Survivors	Patients who died	p Value
AI	27	1.9 (1.0–2.9)	5.2 (4.7–20.1)	0.0007
Surgically treated	17	1.5 (0.9–3.0)	17.1 (5.0–20.2)	0.01
Medically treated	10	2.9 (2.3–3.4)	5.0 (3.6–15.2)	0.05

Values are median (interquartile range).

DISCUSSION

In addition to corroborating our previous results of a 100% sensitivity of a D-dimer cut off concentration of 0.5 μg/ml for acute type A aortic dissection, we found that absolute D-dimer concentrations provide prognostic information about these patients. Increased plasma D-dimer concentrations found in acute aortic dissection reflect endogenous fibrinolytic activity counteracting the activation of the extrinsic pathway of the coagulation cascade; this cascade is triggered by exposure to tissue factor from the dissected aorta. The anatomical extent of the dissection may be hypothesised to

be related to the amount of coagulation and fibrinolytic activation. Therefore, absolute D-dimer concentrations may reflect the anatomical extent of the disease.[2] On the other hand, increased D-dimer concentrations may originate from systemic inflammatory reactions, which have been previously described in patients with acute aortic dissection and which have been shown to be independent predictors of mortality in acute aortic syndromes.[4 5]

Of note, the information provided by D-dimer concentrations is independent of and may be additive to clinical parameters of outcome.

As in most single centre studies on aortic dissection, the main limitation of our study is the small sample size, which can be overcome only by a multicentre approach.

In summary, D-dimer concentrations on admission may provide independent prognostic information about patients with acute aortic type A dissection.

ACKNOWLEDGEMENTS

We are indebted to Drs Josef Seier and Erich Wimmer for measuring D-dimer. We are indebted to Erich Kvas MSc for statistical evaluation.

Authors' affiliations
T Weber, M Rammer, J Auer, E Maurer, B Eber, Cardiology Department, Klinikum der Kreuzschwestern, Wels, Austria
G Aspöck, Laboratory 1, Klinikum der Kreuzschwestern, Wels, Austria

Correspondence to: Dr Thomas Weber, Cardiology Department, Klinikum der Kreuzschwestern, Grieskirchnerstrasse 42, 4600 Wels, Austria; thomas.weber@klinikum-wels.at

Accepted 2 September 2005

REFERENCES

1 **Mehta RH**, Suzuki T, Hagan PG, *et al.* Predicting death in patients with acute type a aortic dissection. *Circulation* 2002;**105**:200–6.
2 **Weber T**, Högler S, Auer J, *et al.* D-dimer in acute aortic dissection. *Chest* 2003;**123**:1375–8.
3 **Eggebrecht H**, Naber CK, Bruch C, *et al.* Value of plasma fibrin D-dimers for detection of acute aortic dissection. *J Am Coll Cardiol* 2004;**44**:804–9.
4 **Shinohara T**, Suzuki K, Okada M, *et al.* Soluble elastin fragments in serum are elevated in acute aortic dissection. *Arterioscler Thromb Vasc Biol* 2003;**23**:1839–44.
5 **Schillinger M**, Domanovits H, Bayegan K, *et al.* C-reactive protein and mortality in patients with acute aortic disease. *Intensive Care Med* 2002;**28**:740–5.

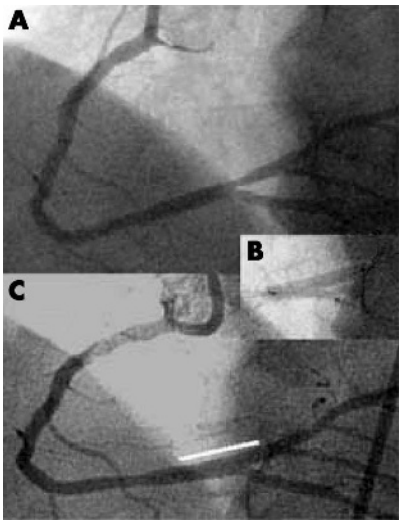
IMAGES IN CARDIOLOGY

doi: 10.1136/hrt.2005.074203

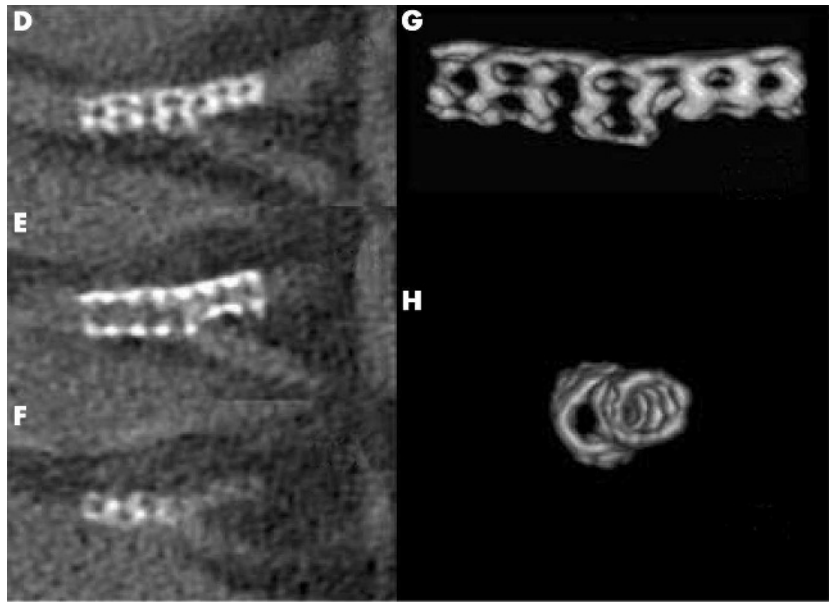
Stent structure after kissing balloon inflation visualised by 64 slice computed tomography

A 63 year old man was admitted to our institution for the treatment of a restenotic lesion after balloon angioplasty, including the bifurcation between the postero-descending artery (PDA) and the posterolateral artery (PLA) of the right coronary artery (RCA). A Cypher stent (3.0 mm × 18 mm) was positioned and deployed from the distal RCA to the PLA, covering the ostium of the PDA. After stent deployment, kissing balloon inflation of the bifurcations was performed (panels A–C). The implanted stent was examined with a 64 slice computed tomographic (CT) scanner (SOMATOM Sensation Cardiac 64; Siemens Medical Solutions, Forchheim, Germany). Axial images were reconstructed using a sharp convolution kernel (B46f), specifically designed for accurate assessment of the coronary stent while minimising artefacts created by surrounding soft tissues. Maximum intensity projection (MIP) and volume rendered images were reconstructed to depict stent structure. MIP images clearly show the detailed structure of the implanted stent (panels D–F). Mesh structure of the stent with a side branch opening is clearly demonstrated with volume rendered three dimensional reconstruction (panels G and H).

M Ehara, M Kawai, T Suzuki
momomar@muc.biglobe.ne.jp



Cypher stent (3.0 mm × 18 mm) implanted at a bifurcation lesion in the distal right coronary artery, followed by additional balloon inflation(s) utilising the ''kissing balloon'' technique. (A) Pre-procedural angiogram. (B) Additional ballooning with kissing technique. (C) The final result. The line represents the stented site.



Panels D–F: Images of thin maximum intensity projection (MIP). Stent struts are clearly seen. Panels G and H: Volume rendered images of the stent. Detailed stent structure revealing a side branch opening created by kissing technique is shown.